Microcellular Foaming of Cellulose acetate Binder-based Combustible Objects by Supercritical CO_2

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BACKGROUND

Foamed Combustible constituent :

Weight reduction

No burden of disposing of spent metal case

Automatic firing

Adding energy

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► **Combustible cartridge cases**

► **Caseless ammunition**

Felt-moulding

Winding

Rolling

RIM process

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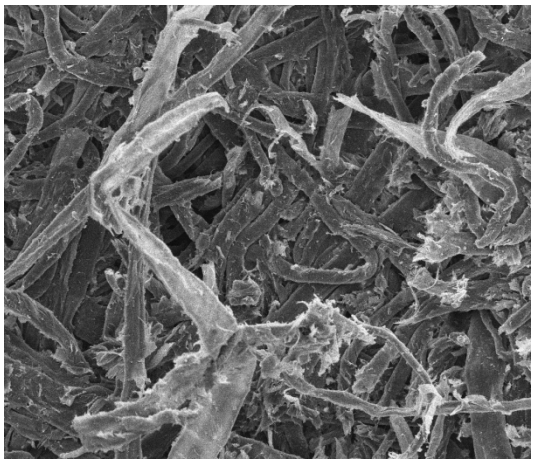
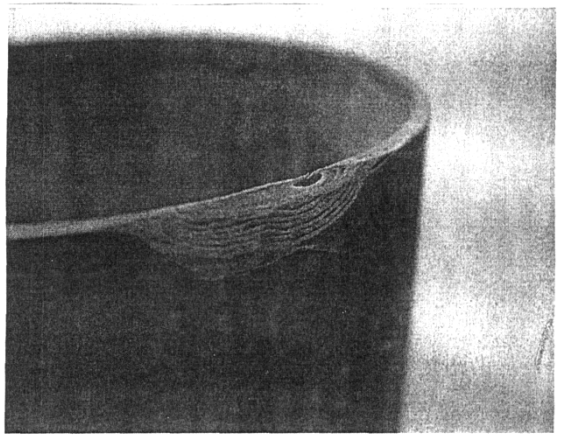
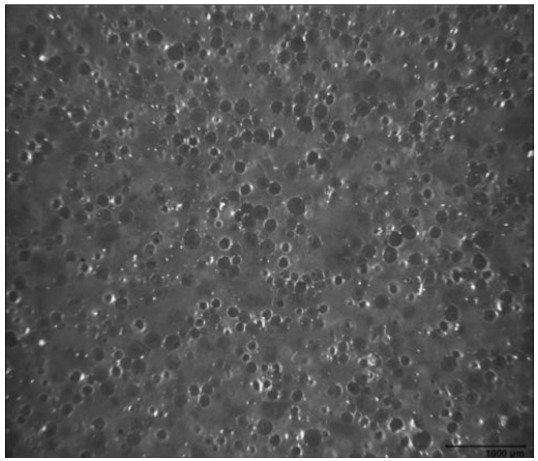


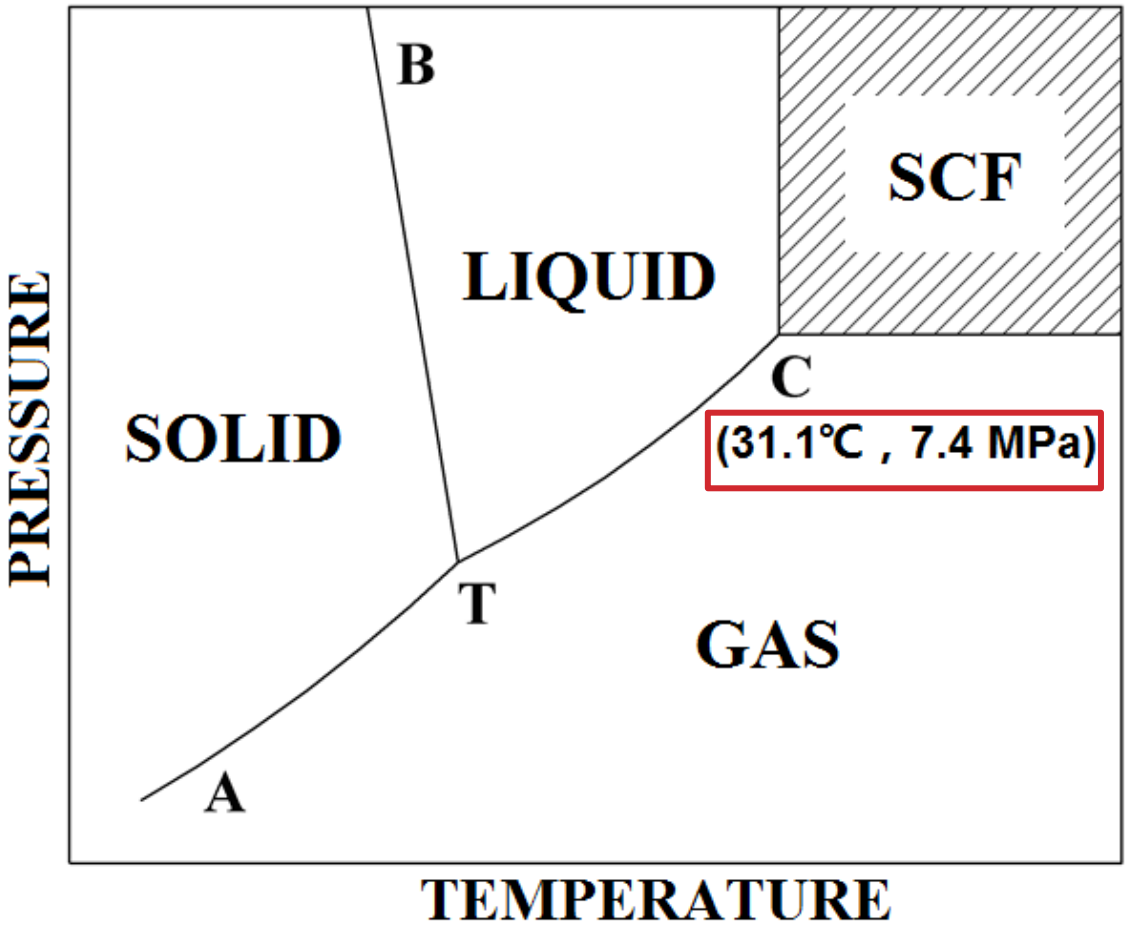
Felted case



Rolling case

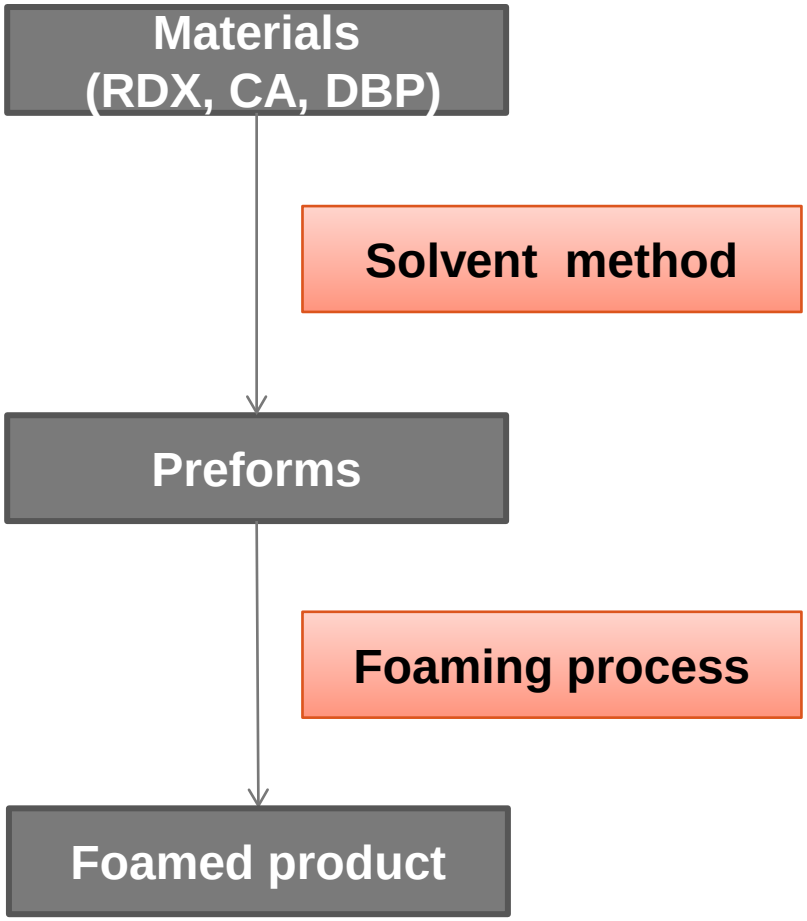


Foamed propellants
from ICT



Temperature-pressure phase transition of pure substance

FABRICATION PROCESS

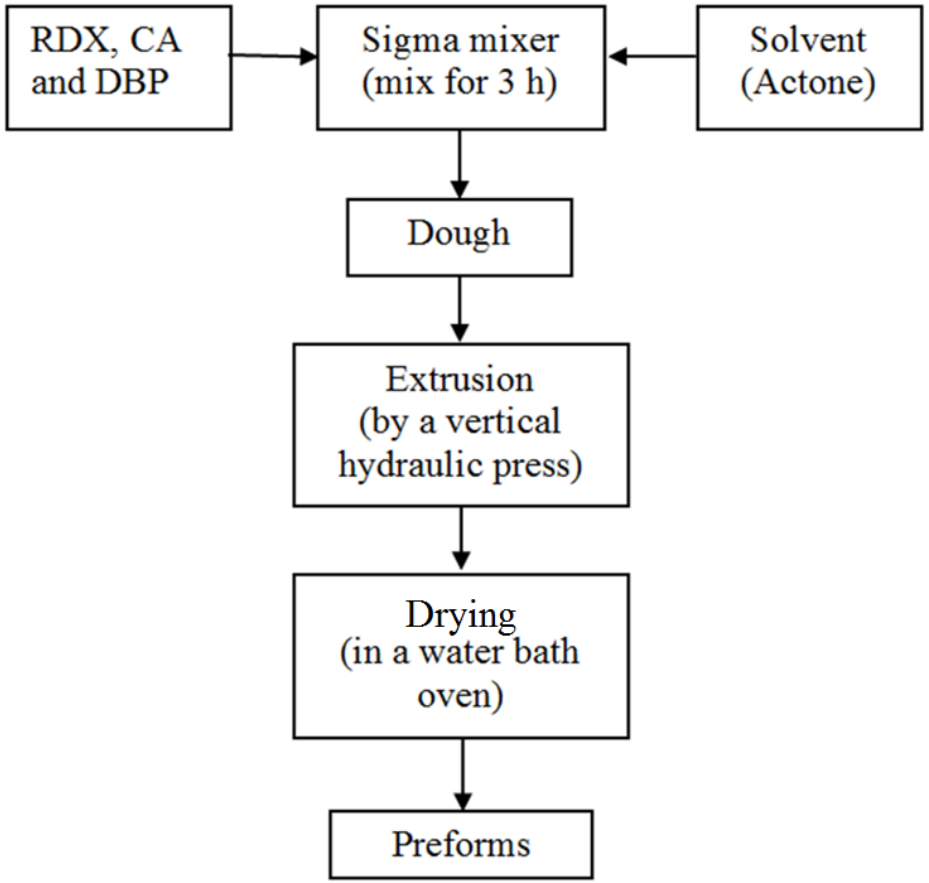


SOLVENT METHOD

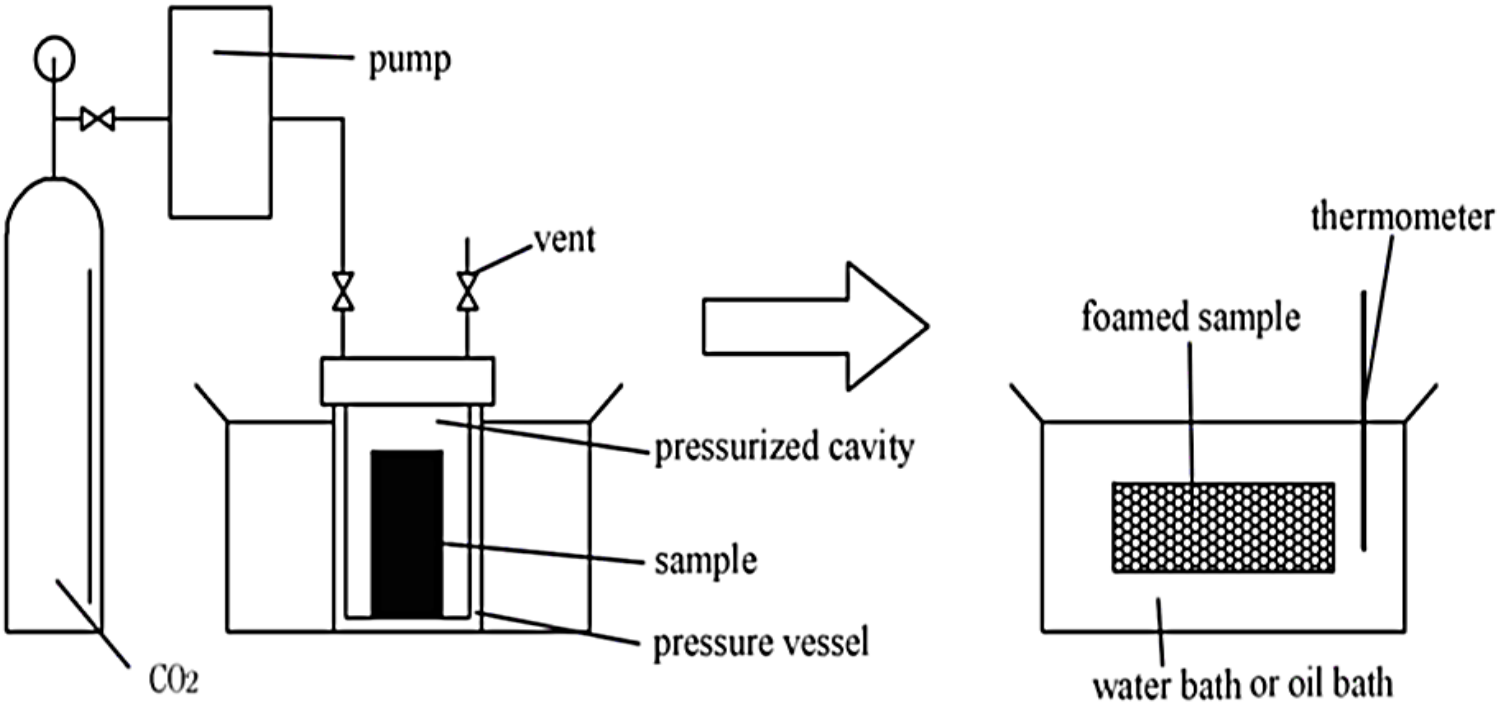
RDX (60% to 70%)

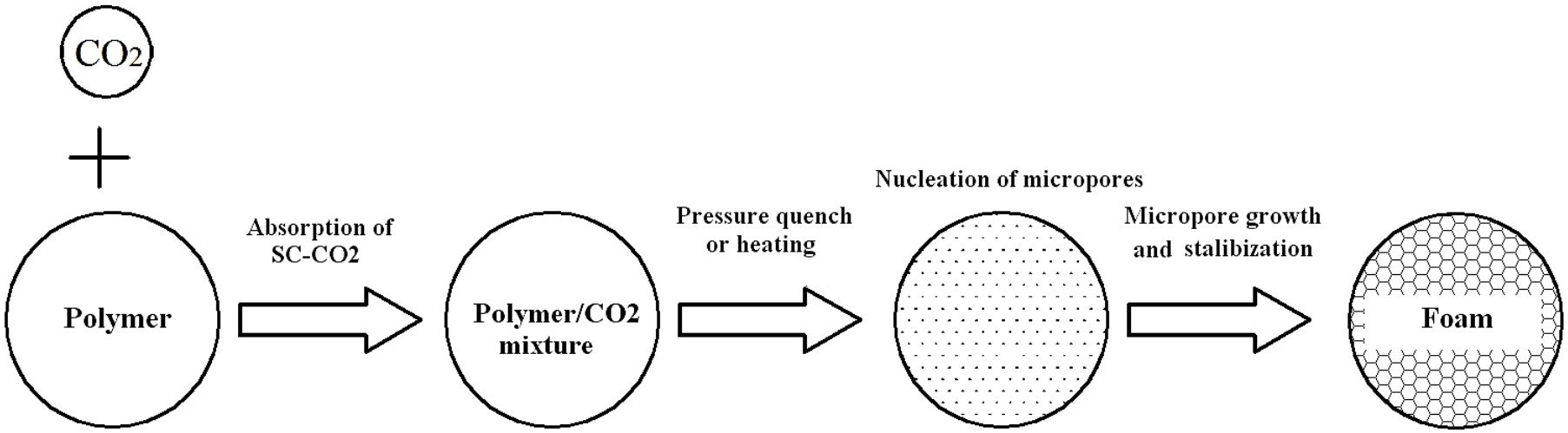
CA (Cellulose acetate)

DBP (Dibutyl phthalate)

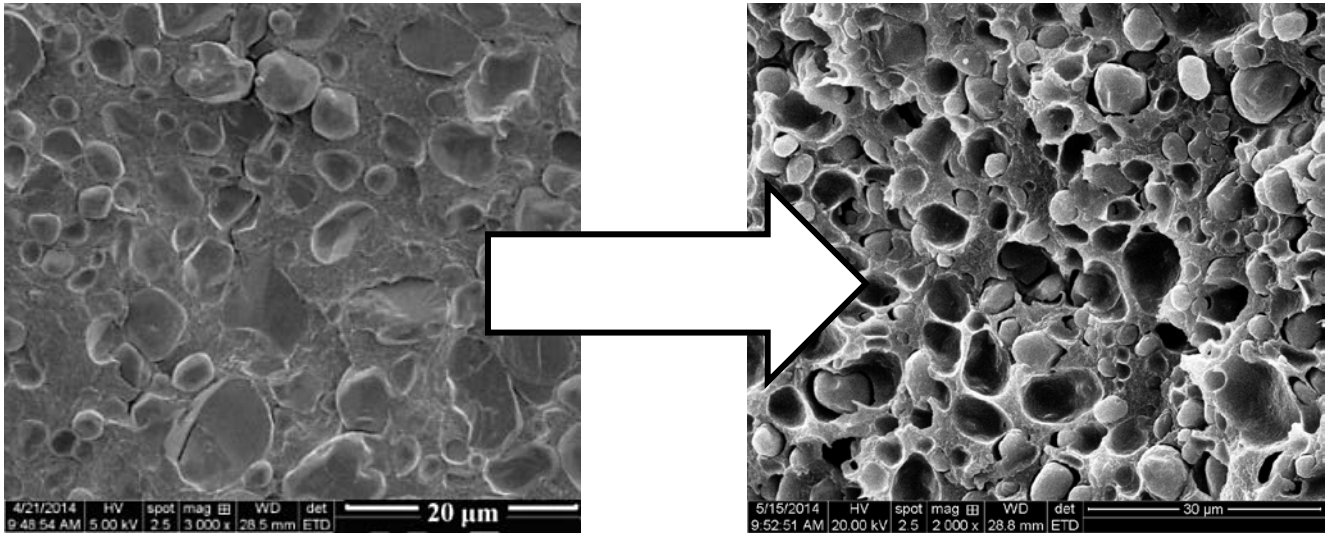


MICROCELLULAR FOAMING PROCESS




CO2
Polymer
Absorption of
SC-CO2
Polymer/CO2
mixture
Pressure quench
or heating
Nucleation of micropores
Micropore growth
and stalibization
Foam

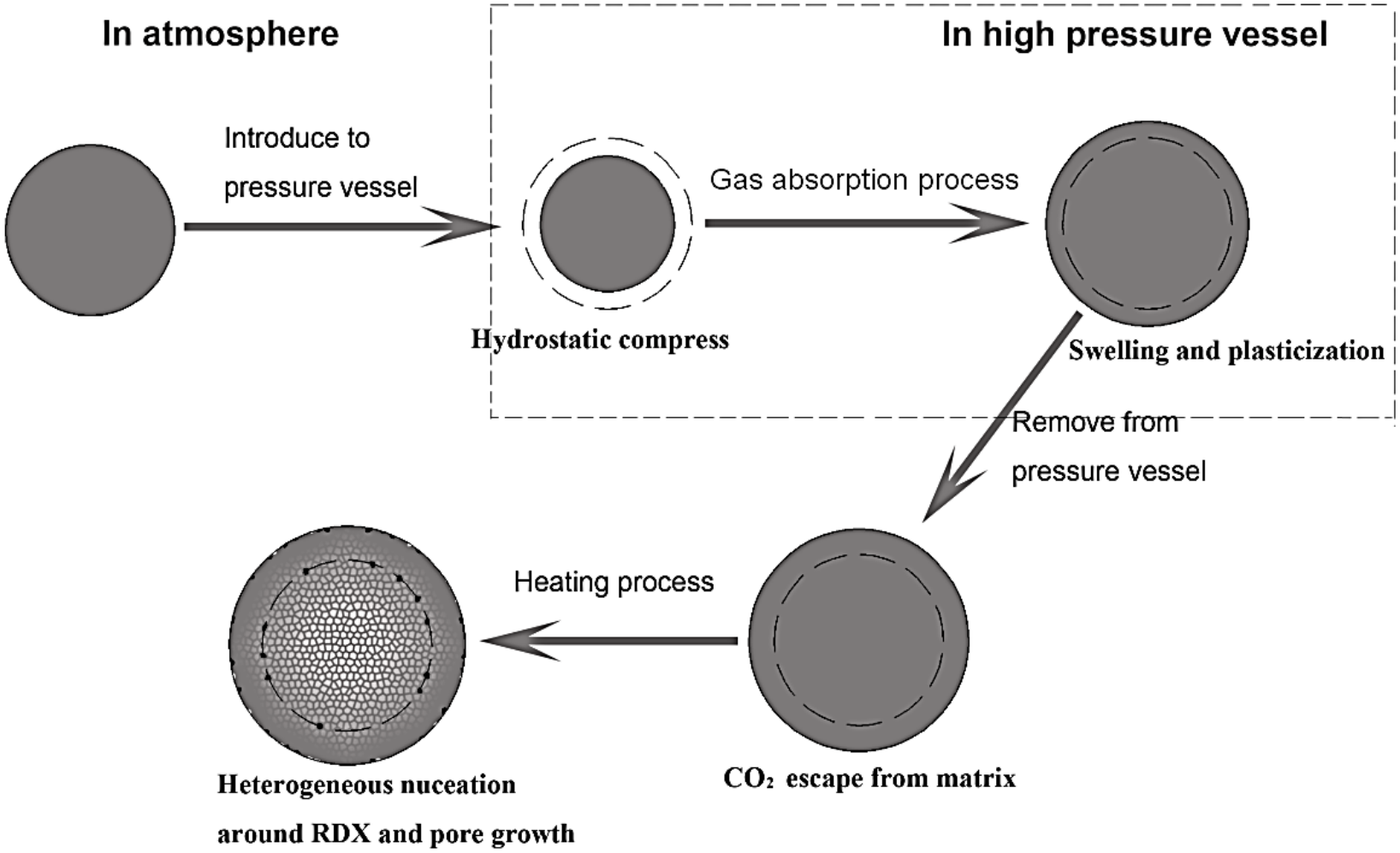
INNER STRUCTURES



Unfoamed sample

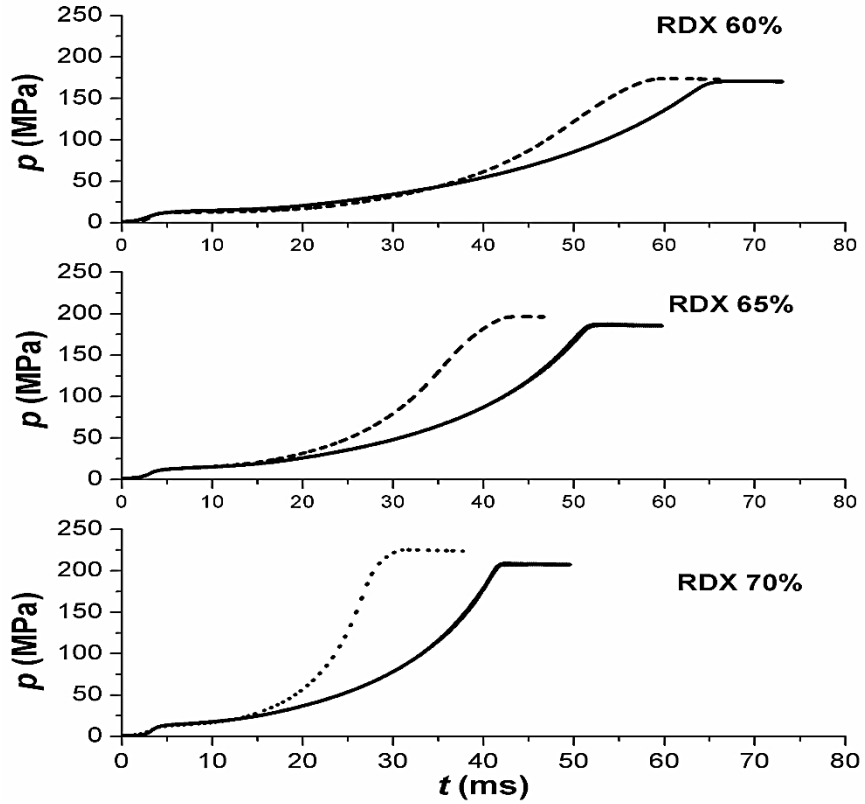
Foamed sample

HETEROGENEOUS NUCLEATION COURSE

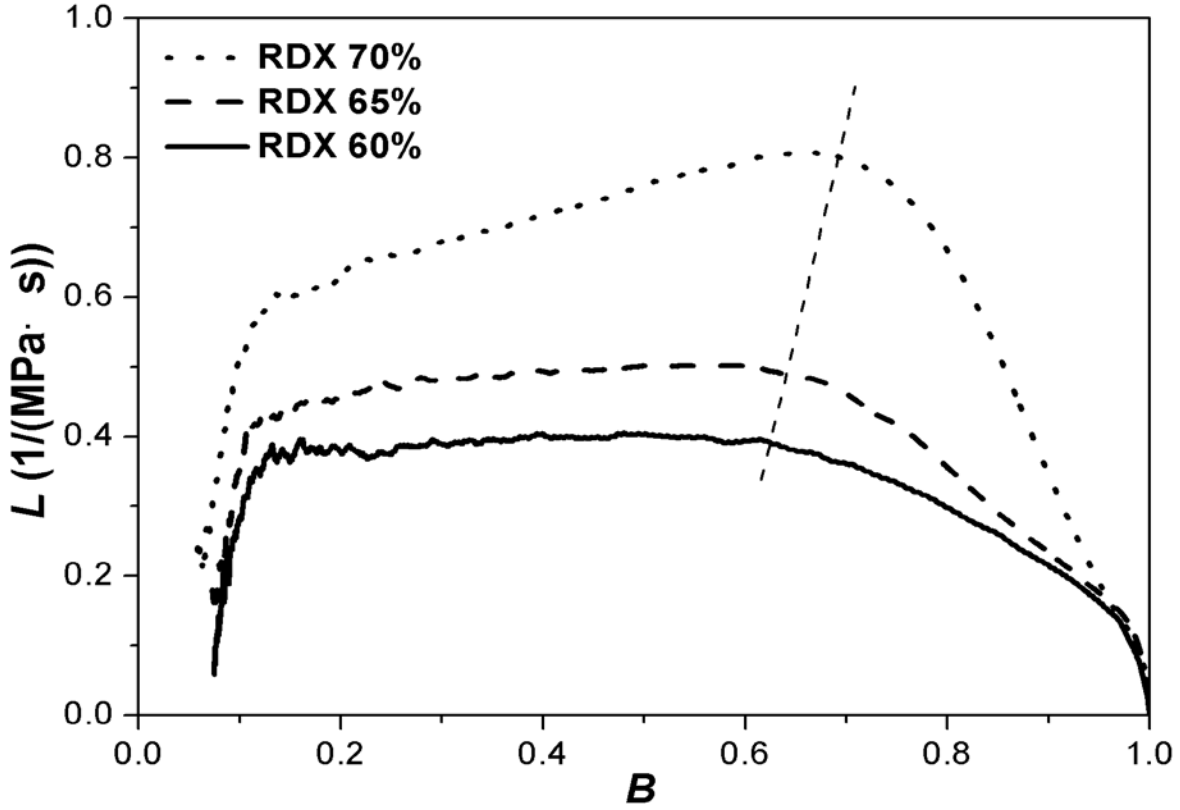


Proposed mechanism for solid-state cell nucleation foaming process.

BURNING BEHAVIORS



***p-t* curves of CA-based samples with different RDX ratios (T_f=95°C, T_s=40°C, P_s = 15MPa):**
(dotted curves are foamed samples, solid curves are un-foamed samples)



***L*-*B* curves for free-foamed samples at different saturation temperatures (T_f=95°C, T_s=40°C, P_s=15MPa):**
(*L*= dynamic vivacity, *B*= pressure/maximum pressure)

INFLUENCING FACTORS

Higher saturation pressure

Higher foaming temperature

Lower saturation temperature

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High tribute shall be paid to Sanjiu Ying and Clive Woodley

THANKS

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